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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/780,177	02/16/2004	Jian Wu	M61.12-0592	1736

27366 7590 12/01/2009

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EXAMINER	
SHAH, PARAS D	

ART UNIT	PAPER NUMBER
2626	

MAIL DATE	DELIVERY MODE
12/01/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/780,177	WU ET AL.	
	Examiner	Art Unit	
	PARAS SHAH	2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 August 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1, 6, 9, 10, 13-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *1, 6, 9, 10* is/are allowed.

6)☒ Claim(s) *13-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This communication is in response to the Amendments and Arguments filed on 08/12/2009. Claims 1, 6, 9, 10, 13-23 remain pending and have been examined, with claims 2-5 and 24 being cancelled. The Applicants' amendment and remarks have been carefully considered, but they do not place the claims in condition for allowance. Accordingly, this action has been made FINAL.

2. All previous objections and rejections directed to the Applicant's disclosure and claims not discussed in this Office Action have been withdrawn by the Examiner.

Response to Amendment and Arguments

3. Applicant's arguments (pages 9-13) filed on 08/12/2009 with regard to claims 1, 6, 9, 10, 13-24 have been fully considered but they are not persuasive.

With respect to claims 1, 6, 9, and 10, such claims are allowed as mentioned below.

With respect to claims 13-23, the Applicants argue claim 13 is not obvious, specifically obtaining a clean speech value and then use the clean speech value to form a filter that is applied to a noisy speech signal, where it is asserted that once a clean speech value is estimated then there would be no need to construct a filter to be applied. The Examiner disagrees with this assertion. Acero provides methodology of determining estimates of clean speech and noise value. Furthermore, Pastor was cited to disclose the usage of estimated values to set a filter to be applied to the noisy speech signal. This is described in col. 6, lines 1-29 and Figure 1, step 5, reconstruction of the

signal from step 4, Wiener filtering. It is described in the former citation that the Wiener filter can be in the form as in equation 7 and previously determined parameters are used as well as directly accessible terms, hence the usage of the second formulation of equation 7. Acero, in estimating the clean speech and noise provides the determination of these parameters making them accessible. Further, Pastor describes the use of the previously determined noise estimate, which also would be obvious to use the previously determined clean speech determined from Acero. The use of these previously determined estimates are required in order to provide filtering of a current input for noise suppression in real time since the previously determined speech and noise estimated are directly accessible. For these reason, the Applicant's arguments are not persuasive.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 13-18, 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over ***Acero*** ("Environmental Robustness in Automatic Speech Recognition" IEEE 1990) in view of ***Pastor*** (6,445,801).

As to claim 13, ***Acero*** discloses a computer-readable medium having computer-executable instructions for performing steps comprising:

obtaining an estimate of a clean speech value and an estimate of a noise value derived from a noisy speech signal (page 850, section 4, *an ML estimator is used to determine the noise vectors, then an MMSE estimator is used to estimate the uncorrupted (clean speech)vector*);

However, ***Acero*** does not disclose setting a numerator of a filter gain ratio as a function of the clean speech value and the noise value, setting a denominator of the filter gain ratio as a function of the clean speech value and the noise value, and using the filter gain ratio in a filter that is applied to the noisy speech signal.

Pastor discloses a numerator of a filter gain ratio as a function of the clean speech value and the noise value (see col. 3, lines 15-24, especially equation of Wiener Filter) (e.g. Manipulation of the equation by substituting $(\gamma_s + \gamma_x)$ for γ_u and making a common denominator yields the numerator being a function of noise and speech);

setting a denominator of the filter gain ratio as the sum of the clean speech value and the noise value (see col. 3, lines 15-24, especially equation of Wiener Filter, Manipulation of the equation by substituting $(\gamma_s + \gamma_x)$ for γ_u in the denominator yields the sum as claimed (see col. 6, lines 20, equation 6, where the equivalence is shown) (e.g. It is inherent from the equation in Pastor that a simple substitution for the power spectral density of the noisy signal with the summing of the speech and noise spectral density is equivalent and using this

substitution for establishing a common denominator. The result yields the sum of the speech and noise in the denominator and the numerator being a function of speech and noise. The clean speech estimate is simply the subtraction of the noisy speech signal by the estimate of the noise.).

using the filter gain ratio in a filter that is applied to the noisy speech signal (see Figure 1, step 5, where the signal is reconstructed from the wiener filtering and see col. 4, lines 59-col. 5, lines 3).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to set a numerator of a filter gain ratio as a function of the clean speech value and the noise value, set a denominator of the filter gain ratio as a function of the clean speech value and the noise value, and use the filter gain ratio in a filter that is applied to the noisy speech signal in ***Acero***, since one of ordinary skill in the art has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of designing a robust noise suppression filter that is robust changing input, as indicated in both ***Acero*** (Abstract) and ***Pastor*** (see col. 2, lines 49-55).

As to claim 14, ***Acero*** in view of ***Pastor*** disclose the method of claim 13, and ***Acero*** further discloses wherein obtaining an estimate of a noise value and comprises estimating the noise value based in part on a parameter that describe a distribution of noise values (page 850, section 4.2, *ML estimation of noise*)..

As to claim 15, ***Acero*** in view of ***Pastor*** disclose the method of claim 14, and ***Acero*** further discloses comprising determining the parameters of the distribution of noise values (page 850, section 4.2, *ML estimation of noise*).

As to claim 16, ***Acero*** in view of ***Pastor*** disclose the method of claim 15, and ***Acero*** further discloses wherein determining the parameters of the distribution of noise values comprises determining the parameters based on multiple segments of the noisy speech signal (page 850, section 4.2, *ML estimation of noise*).

As to claim 17, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 16, and ***Acero*** further discloses wherein determining the parameter comprises determining a mean iteratively, wherein each iteration utilizes an update equation that is formed by maximizing the joint probability of a sequence of observation vectors and a sequence of mixture component indices (page 850, section 4.2, *ML estimation of noise*).

As to claim 18, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further discloses wherein obtaining an estimate of a clean speech value and an estimate of a noise value comprises estimating a cepstral clean speech value and a cepstral noise value in a cepstral domain and converting the cepstral clean speech value and the cepstral noise value into the spectral domain to produce a spectral domain clean speech value and a spectral domain noise value (Abstract and Figure 1, *speech and noise vectors are cepstral vector, and Figure 1*

displays the speech and noise spectrum from the stereo database. Therefore it is inherent the cepstral values are converted to spectrum values).

As to claim 21, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further discloses wherein obtaining an estimate of the noise value comprises utilizing a parameter that describes a distribution for a residue error (page 850, section 4.2, *ML estimation of noise vector* n_k).

As to claim 22, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 13, and ***Acero*** further comprising determining the parameter that describes the distribution for the residue error without using clean speech training data (see sect. 4.2, Ml estimation of noise, where an observation vector, z, and equalization vectors n and q is used for an utterance and the uncorrupted vector x is being determined.).

As to claim 23, ***Acero*** in view of ***Pastor*** disclose the method of claim13, however ***Acero*** does not disclose wherein defining the gain as a ratio comprises defining the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive.

Pastor discloses wherein defining the gain as a ratio comprises defining the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive (see col. 7, lines 38-56, and see col. 3, lines 15-24, where the term alpha is a*max is an overestimation coefficient used).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to define the ratio such that it is guaranteed to be positive if the clean speech value and the noise value are positive in ***Acero***, since one of ordinary skill in the art has good reason to pursue the options within his or her technical grasp in order to achieve the predictable result of designing a robust noise suppression filter for removing noise from useful signals (see Pastor col. 2, lines 50-53).

5. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Acero** in view of **Pastor** as applied to claim 18 above, and further in view of **Arslan** (US 5,706,395).

As to claim 19, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 18.

However ***Acero*** in view of Arslan does not disclose wherein obtaining an estimate of a clean speech value and an estimate of a noise value further comprises smoothing the spectral domain clean speech value and the spectral domain noise value across frequencies.

Arslan discloses smoothing prior to filtering by the wiener filter (column 8 lines 14-40, $W(\omega)$, smoothing window).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to smooth the spectral domain clean speech value and the spectral domain noise value across frequencies in ***Acero*** in view of ***Pastor***,

since it reduces noise fluctuations in the filtered speech signal, as indicated in ***Arslan*** (column 8 lines 25-28).

As to claim 20, ***Acero*** in view of ***Pastor*** disclose the computer-readable storage medium of claim 18.

However ***Acero*** in view of **Pastor** does not disclose wherein obtaining an estimate of a clean speech value and an estimate of a noise value further comprises smoothing the spectral domain clean speech value and the spectral domain noise value across time.

Arslan discloses smoothing prior to filtering by the wiener filter (column 8 lines 14-40, rectangular window with corresponding window in frequency domain, $W(\omega)$).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to smooth the spectral domain clean speech value and the spectral domain noise value across frequencies in ***Acero*** in view of ***Pastor*** , since it reduces noise fluctuations in the filtered speech signal, as indicated in ***Arslan*** (column 8 lines 25-28).

Allowable Subject Matter

6. Claims 1, 6, 9, and 10 are allowed.

7. The following is a statement of reasons for the indication of allowable subject matter: None of the cited prior art either alone or in combination thereof teach the

sequence of limitations as recited in independent claim 1. Specifically, the use of the prior clean speech model to determine the mean and covariance for a distribution of noise vales, smoothing of the clean speech and noise values over time and frequency, where the smoothing for clean speech is across different frames and the utilization of these smooth values in the setting of the gain as recited in the last paragraph of claim1.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chan et al. (US 5,812,970) is cited to disclose noise reduction in a speech signal Chandran et al. (US 6,766,292) is cited to disclose noise ratio weighting and smoothing got noise cancellation. Furuta (US 7,158,932) is cited to disclose noise suppression and smoothing over time and frequency.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SAMUEL GRAHAM whose telephone number is (571)270-16505360. The examiner can normally be reached on MON.-THURS. 7:30a.m.-4:00p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Hudspeth can be reached on (571)272-78437603. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David R Hudspeth/
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/P. S./
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11/24/2009